12.4.4.4 Risk Assessment. Table 12-14 presents the exposure point concentrations used in the baseline risk assessment. Appendix C contains both the summary statistics and exposure point concentrations supporting this assessment.

Table 12-14. Land Mine and Fuze Burn Area Exposure Point Concentration Calculations by Bin Depths.

COPC	0-0.5	0-4	0-10
Area 2			
2,4,6-Trinitrotoluene	1.35E-01	1.12E+00	4.49E-01
2,6-Dinitrotoluene	1.35E-01	5.42E+00	2.17E+00
Lead	1.38E+01	1.59E+01	6.38E+00
Nitrate	1.90E+02	2.13E+02	8.51E+01
Selenium	9.00E-01	1.55E+00	6.22E-01
Area 3			
1,3-Dinitrobenzene	1.30E+03	2.24E+02	8.95E+01
2,4,6-Trinitrotoluene	6.90E+04	1.00E+04	4.01E+03
2,4-Dinitrotoluene	1.30E+03	2.24E+02	8.95E+01
Nitrate	1.60E+03	5.15E+02	2.06E+02
TPH-Diesel	1.51E+02	1.94E+01	7.75E+00
Zinc	4.46E+02	1.36E+02	5.46E+01

EPC units are mg/kg or pCi/g; bin depths are in feet.

12.4.4.4.1 Human Health—The estimated human health risk at the Land Mine and Fuze Burn Area is above the 1E-04 to 1E-06 risk range for future residents. The total estimated risk to future residents is 6E-03 at Area 3 and is associated with ingestion of soil, homegrown produce, and groundwater and dermal contact with soil contaminated with 2,4,6-TNT. Area 2, although it does not have COPCs for human health, has an estimated human health risk of 5E-05 from ingestion of groundwater contaminated with 2,4,6-TNT from Area 3 for future residents. The total estimated risk to both current and future workers is 4E-03 at Area 3 and 4E-11 at Area 2. The primary risk drivers for each of these scenarios are ingestion of and dermal exposure to contaminated soil.

The total noncarcinogenic hazards to future residents at this site are 8E+00 at Area 2 and 7E+02 at Area 3. The total noncarcinogenic hazards to current and future workers are 8E-06 at Area 2 and 7E+01 at Area 3. These hazard values are associated with the same exposure routes as the carcinogenic risks. See Table 12-15 for a summary of the human health risks in this area.

12.4.4.4.2 Ecological—To better characterize the large Land Mine and Fuze Burn Area and to help keep the contaminants limited to the area from which they were found, it was divided into two separate areas. Now, if remediation is needed, it will be limited to the contaminated area and less of the habitat will be destroyed. The COPCs for the ERA include several inorganic and explosive compounds for the surface and subsurface soils. Only COPCs with HQs greater than 10 will be retained for further evaluation in the ERA. These COPCs and HQs are presented in Tables 12-16 and 12-17. COPCs with HQs less than or equal to 10 are eliminated from the ERA because they pose a low risk to ecological

receptors and no longer need to be evaluated. HQs from the contaminants at this site ranged from 1 to 10,000. Risks from these contaminants to reptiles, amphibians, and invertebrates could not be evaluated because of the lack of toxicity data to develop toxicity reference values (the contaminants are discussed in greater detail below; the evaluation of the contaminants may contain a few data gaps because of the lack of toxicity data and are discussed more quantitatively). Also, a few of the COPCs

for this site could not be assessed for ecological risk because of the lack of toxicity information. These COPCs are discussed in greater detail under their designated area.

Area 2

HQs for the COPCs from this study area ranged from 1 to 400. Risks to birds and plants could not be assessed for threats from exposure to 2,4,6-TNT and 2,6-dinitrotoluene. Furthermore, risk to plants could not be assessed for nitrate.

The HQs for the COPCs at the Land Mine and Fuze Burn Area 2 are discussed below.

- 2,4,6-trinitrotoluene HQs at the Land Mine and Fuze Burn Area 2 were all below 1.0.
- 2,6-dinitrotoluene HQs at the Land Mine and Fuze Burn Area 2 were all below 1.0.
- The HQs for exposure to lead ranged from 1 for the sage sparrow (AV222) to 2 for the loggerhead shrike (AV322). The exposure point concentration in the surface soil is 13.8 mg/kg, decreasing to 6.4 mg/kg in the subsurface soil. The INEEL background concentration for lead is 17 mg/kg. Therefore, an average species may be exposed to the same magnitude of risk from exposure to background. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.

Table 12-15. Human health carcinogenic risk and noncarcinogenic hazard index summary for the Land Mine and Fuze Burn Area.

	Risk Scenario			Hazard Index Scenario		
COPC	Residential	Current Worker	Future Worker	Residential	Current Worker	Future Worker
Area 2						
2,4,6-TNT	5E-05	4E-11	4E-11	8E+00	8E-06	8E-06
Area 3						
2,4,6-TNT	6E-03	4E-03	4E-03	7E+02	7E+01	7E+01
Total Risk/HQ for Scenario	6E-03	4E-03	4E-03	7E+02	7E+01	7E+01

Source: HHRA Spreadsheets. See Appendix E.

Table 12-16 Summary of ERA HQs for the Land Mine and Fuze Burn Area 2 [a]

COPCs Receptors	Lead HQs	Nitrate HQs	Selenium HQs
Black-billed magpie	—	1	—
Deer mouse	—	1	—
Loggerhead shrike	2	2	—
Mourning dove	—	3	—
Pygmy rabbit	—	1	—
Sage sparrow	1	3	2
Townsend's western big-eared bat	—	2	1

a. COPCs with HQs less than one are not presented in this table.

Table 12-17. Summary of ERA HQs for the Land Mine and Fuze Burn Area 3

COPCs Receptors	2,4,6-TNT HQs	Nitrate HQs	TPH-diesel HQs	Zinc HQs
Deer mouse	900	—	—	—
Plants	—	—	—	10
Pygmy rabbit	10,000	5	5	3

COPCs with HQs less than one are not presented in this table

- The HQs for exposure to nitrate ranged from 1 for black-billed magpie (AV422), pygmy rabbit (M122A), and deer mouse (M422), to 2 for the loggerhead shrike (AV322) and Townsend's western big-eared bat (M210A) to 3 for the mourning dove (AV122) and sage sparrow (AV222). The exposure point concentration in the surface soil is 190 mg/kg, decreasing to 85.1 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The HQs for exposure to selenium ranged from 1 for the Townsend's western big-eared bat (M210A) to 2 for the sage sparrow (AV222). The exposure point concentration in the surface

  soil is 0.9 mg/kg, decreasing to 0.62 mg/kg in the subsurface soil. The INEEL background concentration for selenium is 0.22 mg/kg. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that the Land Mine and Fuze Burn Area 2 has limited risk to ecological receptors from exposure to soils. No COPCs were retained for further evaluation in the ERA for this area.

Area 3

HQs for the COPCs from this study area ranged from 1 to 10,000. Risks to birds and plants could not be assessed for threats from exposure to 2,4,6-TNT, and TPH. Furthermore, risk to plants could not be assessed for nitrate.

The HQs for the COPCs at the Land Mine and Fuze Burn Area 3 are discussed below.

- 1,3-dinitrobenzene and 2,4-dinitrotoluene were not assessed as a contaminant at the Land Mine and Fuze Burn Area because of uncertainties associated with the laboratory analysis. The exposure point concentrations used in the ERA were based on sample results that the laboratory flagged as a nondetect. There were significant issues with the laboratory methods and the sample matrix that resulted in extremely high detection limits. These uncertainties limit the ability to determine risk to ecological receptors. However, the Land Mine and Fuze Burn Area is currently being evaluated for remediation from 2,4,6-TNT contamination, and presumably 1,3-dinitrobenzene and 2,4-dinitrotoluene would also be treated or removed as part of that remediation action. Postremedial sampling for the Land Mine and Fuze Burn Area would also include analyzing for 1,3-dintrobenzene and 2,4-dinitrotoluene to determine if any residual contamination is left behind.

- The HQs for exposure to 2,4,6-TNT ranged from 900 for the deer mouse (M422) to 10,000 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 69,000 mg/kg, decreasing to 4,010 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10 for both species.

- The only HQ greater than 1 for exposure to nitrate was a 5 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 1,600 mg/kg, decreasing to 206 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The only HQ greater than 1 for the exposure to TPH-diesel was a 5 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 151 mg/kg, decreasing to 7.75 mg/kg in the subsurface soil. Toxicity reference values from benzene were used to evaluate this contaminant because benzene is the most hazardous chemical found in TPH-diesel. This was done because toxicity reference values for TPH-diesel could not be developed, owing to the lack of toxicity data. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The HQs for exposure to zinc ranged from 3 for the pygmy rabbit (M122A) to 10 for the plants (all vegetation). The exposure point concentration in the surface soil is 446 mg/kg, decreasing to 54.6 mg/kg in the subsurface soil. The INEEL background concentration for zinc is 150 mg/kg. This contaminant was eliminated as a COPC because the HQs were equal to or below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that the Land Mine and Fuze Burn Area 3 has risk to ecological receptors from exposure to 2,4,6-TNT and possibly 1,3-dinitrotoluene, 2,4-dinitrotoluene.

In summary, based on dose and HQ calculations and background comparisons, the primary potential risk-driver at the Land Mine and Fuze Burn Area is 2,4,6-TNT and possibly 1,3-dinitrotoluene,

2,4-dinitrotoluene (at Area 3) in soil. The risk from UXO to ecological receptors is considered low. Complete ERA results are presented in Appendix F.

12.4.5 National Oceanic and Atmospheric Administration Grid

12.4.5.1 Site Description. The NOAA site is located just east of Lincoln Boulevard, approximately midway between Mile Markers 4 and 5 (Figure 12-6). The site is thought to have been used for a variety of explosive tests or cleanup detonations or both following such tests. The area contains a number of small craters, low-ordered bomb casings and detonators, and some widely scattered pieces of explosives. The NOAA Grid has been and is currently used by NOAA and other governmental agencies for a variety of atmospheric, geodetic, and weather-related monitoring and research work (DOE-ID 1997).

12.4.5.2 Previous Investigations. During the 1993 interim action, a surface clearance and a geophysical search were performed to a depth of 0.61 m (2 ft) on a large site consisting of 1.7 ha (4.13 acres) and a small site consisting of 0.88 ha (2.17 acres) (see map in Appendix H/ DOE-ID 1997). No UXO was found below the surface. Pieces of TNT remain at the surface of this site (DOE-ID 1997).

During the 1996 field assessment, the major concerns of the field team were to determine whether ordnance or soil contamination existed outside of the previously identified area, to establish the boundary, to reestimate the volume of contaminated soil, and to look for any indications that detonation pits existed in the area. This area was searched on foot by field crews at approximately 10-m (33-ft) intervals. Scattered TNT was located, ranging from small flakes to baseball-size chunks. The area of contamination covers a large area (see map in Appendix H). Several craters were located on the south side of the site. It appears that they were sites of ordnance destruction. Several partial 100-lb bombs were found southeast of the NOAA site, which indicates they had been intentionally *low-ordered.* A low-order detonation is the result of a low-order procedure, intended to detonate an explosive item without causing the item to totally consume itself. A low-order procedure is performed in an area that could not withstand a high-order detonation, which would have totally consumed the item (DOE-ID 1997). In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999b).

12.4.5.3 Preliminary Screening. The soil data collected from the 1999 field sampling were screened for COPCs. The results of that screen are presented in Table 12-18. The HHRA and ERA screening methodology are discussed in Section 4 and presented in detail in Appendices D and F, respectively.

2,4,6-TNT and RDX were retained as COPCs for the HHRA because the maximum detected concentrations exceeded the RBCs. 1,3,5-trinitrobenzene, 2,4,6-TNT, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, nitrite, and RDX were retained as COPCs for the ERA because EBSLs have not yet been established for these contaminants. 1,3-dinitrobenzene and nitrate were also retained as COPCs for the ERA because the maximum concentrations exceeded the ecologically based screening levels (EBSLs).

12.4.5.4 Nature and Extent of Contamination. The NOAA soils site was considered to represent seven separate areas of contamination. Maximum detected contamination levels are listed below for all HHRA and ERA COPCs. All contamination occurs at 0 to 0.61 m (0 to 2 ft) bgs.

Area	Compound	Concentration (ppm)
1.		
	- Nitrate	2.90E+02
	- Nitrite	6.50E+01
2.		
	- 1,3,5-Trinitrobenzene	4.00E-01
	- 2,4,6-TNT	4.20E-01
	- 4-Amino-2,6-Dinitrotoluene	2.80E-01
	- Nitrate	3.10E+02
	- Nitrite	5.50E+01
2a.		
	- 1,3,5-Trinitrobenzene	1.84E+01
	- 2,4,6-TNT	1.70E+04
	- RDX	5.30E+01
3.		
	- 2,4,6-TNT	4.01E+02
	- Nitrate	3.00E+02
	- Nitrite	5.50E+01
	- RDX	1.03E+01
4.		
	- Nitrate	2.10E+02
5.		
	- 1,3,5-Trinitrobenzene	7.70E+01
	- 2,4,6-TNT	1.90E+03
	- 2-Amino-4,6-Dinitrotoluene	3.10E-01
	- Nitrate	4.10E+02
6.		
	- 1,3,5-Trinitrobenzene	3.20E+00
	- 1,3-Dinitrobenzene	5.00E-01
	- 2,4,6-TNT	4.80E+02
	- 2-Amino-4,6-Dinitrotoluene	2.70E+00
	- 4-Amino-2,6-Dinitrotoluene	2.80E+00
	- Nitrate	2.50E+02

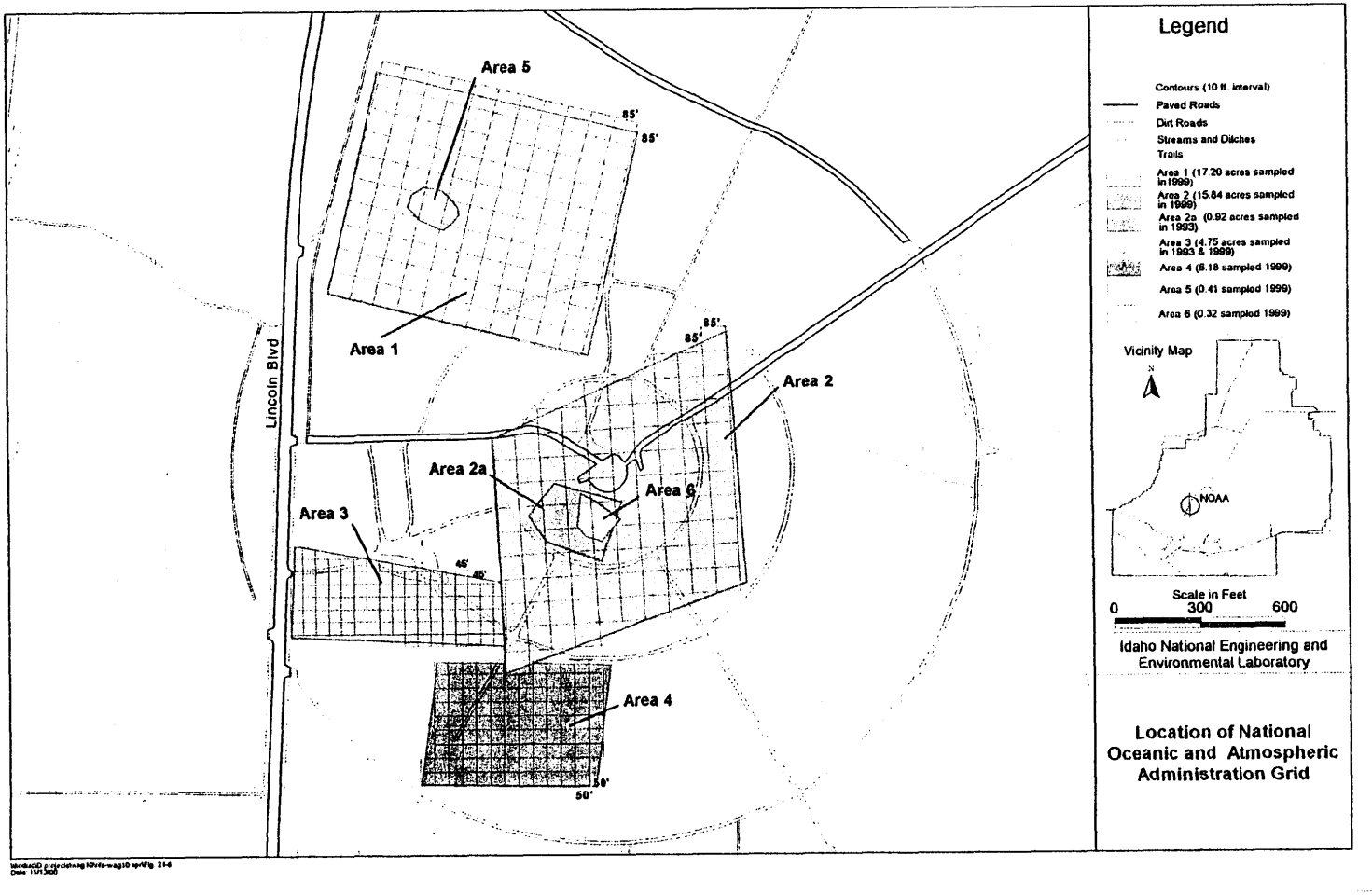

Figure 12-6. Location of the NOAA Grid.

Table 12-18. Soil contaminant screening process for OU 10-04, NOAA Soils (1999).

		Step 1		Step 2	Step 3		Step 4		Site COPC	
Detected Contaminants	Max. Source Concentration (mg/kg)	INEEL Background Concentration (mg/kg)	Max. Concentration > Background	Nontoxic Metal	Region 9/3 RBC (mg/kg)	Max. Concentration > RBC	INEEL EBSL (mg/kg)	Max. Concentration > EBSL	HHRA	ERA
Area 1										
Nitrate	2.90E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	6.50E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes
Area 2										
1,3,5-Trinitrobenzene	4.00E-01	NA	NA	No	1.83E+03	No	No EBSL	No EBSL	No	Yes
2,4,6-TNT	4.20E-01	NA	NA	No	1.62E+01	No	No EBSL	No EBSL	No	Yes
4-Amino-2,6-Dinitrotoluene	2.80E-01	NA	NA	No	4.70E+00	No	No EBSL	No EBSL	No	Yes
Nitrate	3.10E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	5.50E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes
Area 2a										
1,3,5-Trinitrobenzene	1.84E+01	NA	NA	No	1.83E+03	No	No EBSL	No EBSL	No	Yes
2,4,6-TNT	1.70E+04	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
RDX	5.30E+01	NA	NA	No	4.42E+00	Yes	No EBSL	No EBSL	Yes	Yes
Area 3										
2,4,6-TNT	4.01E+02	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
Nitrate	3.00E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	5.50E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes
RDX	1.03E+01	NA	NA	No	4.42E+00	Yes	No EBSL	No EBSL	Yes	Yes

Table 12-18. (continued).

Area 4										
Nitrate	2.10E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Area 5										
1,3,5-Trinitrobenzene	7.70E+01	NA	NA	No	1.83E+03	No	No EBSL	No EBSL	No	Yes
2,4,6-TNT	1.90E+03	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
2-Amino-4,6-Dinitrotoluene	3.10E-01	NA	NA	No	4.70E+00	No	No EBSL	No EBSL	No	Yes
Nitrate	4.10E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Area 6										
1,3,5-Trinitrobenzene	3.20E+00	NA	NA	No	1.83E+03	No	No EBSL	No EBSL	No	Yes
1,3-Dinitrobenzene	5.00E-01	NA	NA	No	6.11E+00	No	7.82E-02	Yes	No	Yes
2,4,6-TNT	4.80E+02	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
2-Amino-4,6-Dinitrotoluene	2.70E+00	NA	NA	No	4.70E+00	No	No EBSL	No EBSL	No	Yes
4-Amino-2,6-Dinitrotoluene	2.80E+00	NA	NA	No	4.70E+00	No	No EBSL	No EBSL	No	Yes
Nitrate	2.50E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes

Source: WAG 10, OU 10-04 Database.

"NA" in Step 1 indicates that a background value is not available.

"No RBC" indicates that an EPA Region IX or 3 RBC based on residential soil ingestion is not available.

"No EBSL" indicates that an INEEL ecologically based screening level is not available.

12.4.5.5 Risk Assessment.

12.4.5.5.1 Human Health—The estimated human health risk at the NOAA Grid varies by area (Table 12-19).

The total human health risk for future residents is above the 1E-04 to 1E-06 target risk range for areas 5 and 6. The primary contributors to risk for these areas are dermal absorption of soil and ingestion of homegrown produce contaminated with 2,4,6-TNT. The total human health risks for current and future workers are within the target risk range.

The total noncarcinogenic hazards to future residents are well above 1 for all areas. The total noncarcinogenic hazards to current and future workers are above 1 at Area 5. These hazard values are associated with ingestion of soil, groundwater, and homegrown produce contaminated with 2,4,6-TNT.

Ecological—***To better characterize NOAA to help keep the contaminants limited to the area in which they were found and it was divided into six separate areas. Then, if remediation is needed, it will be limited to the contaminated area and less of the habitat would be destroyed. The COPCs for the ERA include several inorganic and explosive compounds for the surface and subsurface soils. Only COPCs with HQs greater than 10 will be retained for further evaluation in the ERA. These HQs and COPCs are presented in Tables12-20 through 12-26. COPCs with HQs less than or equal to 10 are eliminated from the ERA because they pose a low risk to ecological receptors and no longer need to be evaluated. HQs for the COPCs from this site ranged from 1 to 500. Risks from the COPCs to reptiles, amphibians, and invertebrates could not be evaluated because of the lack of toxicity data to develop toxicity reference values (as the contaminants are discussed in greater detail below, they*** may contain a few more data gaps because of the lack of toxicity data and will be discussed more quantitatively). Also, a few of the COPCs for this site could not be assessed for ecological risk because of the lack of toxicity information. These COPCs will be discussed in greater detail under their designated area.

Area 1

HQs for the COPCs from this area ranged from 1 to 5. Furthermore, risk to plants could not be assessed from nitrate and nitrite.

Table 12-19. Human health carcinogenic risk and noncarcinogenic hazard index summary for NOAA Grid.

	Risk Scenario			Hazard Index Scenario		
Area	Residential	Current Worker	Future Worker	Residential	Current Worker	Future Worker
2	4E-05	2E-08	2E-08	6E+00	6E-04	6E-04
2a	1E-04	5E-05	8E-05	2E+01	9E-01	9E-01
3	8E-05	2E-05	2E-05	1E+01	4E-01	4E-01
5	1E-03	1E-04	1E-04	1E+02	2E+00	2E+00
6	4E-04	3E-05	3E-05	4E+01	6E-01	6E-01

Source: HHRA Spreadsheets. See Appendix E.

- The HQs for exposure to nitrate ranged from 1 for the black-billed magpie (AV422) to 2 for the pygmy rabbit (M122A) and deer mouse (M422) to 3 for the mourning dove (AV122) to 4 for the loggerhead shrike (AV322) and Townsend's western big-eared bat (M210A) to 5 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 290 mg/kg, decreasing to 81 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The only HQ greater than 1 for exposure to nitrite was a 1 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 65 mg/kg, decreasing to 26 mg/kg in the subsurface soil. The INEEL background value for nitrite has been neither evaluated nor made available at this time. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 1 at NOAA has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for NOAA Grid Area 1.

The HQs for the COPCs at NOAA Grid Area 1 are discussed below.

Area 2

HQs for the COPCs from this area ranged from 1 to 5. Risks to birds and plants could not be assessed from exposure to 1,3,5-trinitrobenzene, 2,4,6-TNT, and 4-amino-2,6-dinitrotoluene. Furthermore, risk to plants could not be assessed for nitrate and nitrite.

The HQs for the COPCs at NOAA Area 2 are discussed below.

Table 12-20. Summary of ERA HQs for NOAA Grid Area 1

COPCs Receptors	Nitrate HQs	Nitrite HQs
Black-billed magpie	1	—
Deer mouse	2	—
Loggerhead shrike	4	—
Mourning dove	3	—
Pygmy rabbit	2	—
Sage sparrow	5	1
Townsend's western big-eared bat	4	—

COPCs with HQs less than one are not presented in this table.

- 1,3,5-trinitrobenzene HQs at NOAA Area 2 were all below 1.0.
- 2,4,6-TNT HQs at NOAA Area 2 were all below 1.0.
- 4-amino-2,6-dinitrotoluene HQs at this area were all below 1.0.
- The HQs for exposure to nitrate ranged from 1 for the black-billed magpie (AV422), pygmy rabbit (M122A) and deer mouse (M422) to 3 for the mourning dove (AV122) to 4 for the loggerhead shrike (AV322) and Townsend's western big-eared bat (M210A) to 5 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 310 mg/kg, decreasing to 92.5 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

  The HQs for exposure to nitrite ranged from 1 for the mourning dove (AV122), loggerhead shrike (AV322), and Townsend's western big-eared bat (M210A) to 2 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 115 mg/kg, decreasing to 46 mg/kg in the subsurface soil. The INEEL background value for nitrite has been neither evaluated nor made available at this time. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 2 at NOAA has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for NOAA Grid Area 2.

Table 12-21. Summary of ERA HQs for NOAA Grid Area 2.

COPCs Receptors	Nitrate HQs	Nitrite HQs
Black-billed magpie	1	—
Deer mouse	2	—
Loggerhead shrike	4	1
Mourning dove	3	1
Pygmy rabbit	2	—
Sage sparrow	5	2
Townsend's western big-eared bat	4	1

COPCs with HQs less than one are not presented in this table.

Area 2a

HQs for the COPCs from this area ranged from 1 to 200. Risks to birds and plants could not be assessed for threats from exposure to 1,3,5-trinitrobenzene, 2,4,6-TNT, and RDX.

The HQs for the COPCs at NOAA Area 1 are discussed below.

- 1,3,5-Trinitrobenzene HQs at NOAA Area 2a were all below 1.0.
- The HQs for exposure to 2,4,6-TNT ranged from 3 for the mule deer (M122) to 100 for the deer mouse (M422) to 200 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 864 mg/kg, decreasing to 43.2 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10.
- The HQs for exposure to RDX ranged from 6 for the deer mouse (M422) to 10 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 1.17 mg/kg, decreasing to 0.058 mg/kg in the subsurface soil. This contaminant was eliminated as a COPC because the HQs were equal to or below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 2a at NOAA has limited risk to ecological receptors, except for exposure to 2,4,6-TNT, from exposure to soils from this area.

Area 3

HQs for the COPCs from this area ranged from 1 to 100. Risks to birds and plants could not be assessed from exposure to 2,4,6-TNT and RDX. Furthermore, risk to plants could not be assessed for nitrate and nitrite.

Table 12-22. Summary of ERA HQs for NOAA Grid Area 2a

COPCs Receptors	2,4,6-TNT HQs	RDX HQs
Deer mouse	100	6
Mule deer	5	—
Pygmy rabbit	200	10

COPCs with HQs less than one are not presented in this table.

Table 12-23. Summary of ERA HQs for NOAA Grid Area 3.

COPCs Receptors	2,4,6-TNT HQs	Nitrate HQs	RDX HQs
Deer mouse	60	—	10
Loggerhead shrike	—	2	—
Mule deer	7	2	1
Pygmy rabbit	100	2	20
Sage sparrow	—	5	—
Townsend's western big-eared bat	—	3	—

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at NOAA Area 3 are discussed below.

- The HQs for exposure to 2,4,6-TNT ranged from 7 for the mule deer (M122) to 60 for the deer mouse (M422) to 100 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 401 mg/kg, decreasing to 20.1 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10.

- The HQs for exposure to nitrate ranged from 2 for the loggerhead shrike (AV322), pygmy rabbit (M122A), and deer mouse (M422) to 3 for the Townsend's western big-eared bat (M210A) to 5 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 300 mg/kg, decreasing to 120 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- Nitrite HQs at NOAA Area 3 were all below 1.0. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data.

- The HQs for exposure to RDX ranged from 1 for the mule deer (M122) to 10 for the deer mouse (M422) to 20 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 1.78 mg/kg, decreasing to 0.14 mg/kg in the subsurface soil. This contaminant is above the low risk HQ of 10.

The risk evaluation indicates that Area 3 at NOAA has a risk to ecological receptors from 2,4,6-TNT and RDX.

Area 4

HQs for the COPCs from this area ranged from 1 to 3. Risk to plants could not be assessed for nitrate.

Table 12-24. Summary of ERA HQs for NOAA Grid Area 4.

COPC Receptors	Nitrate HQs
Deer mouse	1
Loggerhead shrike	1
Pygmy rabbit	1
Sage sparrow	3
Townsend's western big-eared bat	3

COPCs with HQs less than one are not presented in this table.

The HQs for the COPC at NOAA Area 4 are discussed below:

- The HQs for exposure to nitrate ranged from 1 for the loggerhead shrike (AV322), pygmy rabbit (M122A) and deer mouse (M422) to 3 for the sage sparrow (AV222) and Townsend's western big-eared bat (M210A). The exposure point concentration in the surface soil is 210 mg/kg, decreasing to 80.5 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 4 at NOAA has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for the NOAA Grid Area 4.

Area 5

HQs for the COPCs from this area ranged from 1 to 500. Risks to birds and plants could not be assessed for threats from exposure to 2-amino-4,6-dinitrotoluene and 2,4,6-TNT. Furthermore, risk to plants could not be assessed for nitrate.

Table 12-25. Summary of ERA HQs for NOAA Grid Area 5.

COPCs Receptors	1,3,5-trinitrobenzene HQs	2,4,6-TNT HQs	Nitrate HQs
Deer mouse	1	300	3
Mule deer	—	4	—
Pygmy rabbit	2	500	3
Sage sparrow	—	—	4

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at NOAA Area 5 are discussed below:

- The HQs for exposure to 1,3,5-trinitrobenzene ranged from 1 for the deer mouse (M422) to 2 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 77 mg/kg, decreasing to 30.8 mg/kg in the subsurface soil. This contaminant was eliminated as COPCs because the HQs fell below 10, which indicates a low risk to ecological receptors.

- 2-amino-4,6-dinitrotoluene HQs at NOAA Area 5 were all below 1.0.

- The HQs for exposure to 2,4,6-TNT ranged from 4 for the mule deer (M122) to 300 for the deer mouse (M422) to 500 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 1,900 mg/kg, decreasing to 655 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10.

- The HQs for exposure to nitrate ranged from 3 for the pygmy rabbit (M122A), deer mouse (M422), and sage sparrow (AV222). The exposure point concentration in the surface soil is 410 mg/kg, decreasing to 119 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 5 at NOAA has a risk to ecological receptors from 2,4,6-TNT.

Area 6

HQs for the COPCs from this area ranged from 1 to 200. Risks to birds and plants could not be assessed for threats from exposure to 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2-amino-4,6-dinitrotoluene, 2,4,6 TNT, and 4-amino-2,6-dinitrotoluene. Furthermore, risk to plants could not be assessed for nitrate.

The HQs for the COPCs at NOAA Area 6 are discussed below.

- 1,3,5-trinitrobenzene HQs at NOAA Area 6 were all below 1.0.

- The HQs for exposure to 1,3-dinitrobenzene ranged from 1 for the mule deer (M122), to 60 for the deer mouse (M422) to 200 for the pygmy rabbit (M122A). The exposure point

Table 12-26. Summary of ERA HQs for NOAA Grid Area 6

COPCs Receptors	1,3-dinitrobenzene HQs	2,4,6-TNT HQs	Nitrate HQs
Deer mouse	60	70	2
Mule deer	1	1	—
Pygmy rabbit	200	100	2
Sage sparrow	—	—	2

COPCs with HQs less than one are not presented in this table.

concentrations in the surface soil is 27 mg/kg, decreasing to 10.8 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10.

- 2-amino-4,6-dinitrotoluene HQs at NOAA Area 6 were all below 1.0.

- The HQs for exposure to 2,4,6-TNT ranged from 1 for the mule deer (M122) to 70 for the deer mouse (M422) to 100 for the pygmy rabbit (M122A). The exposure point concentrations in the surface soil is 480 mg/kg, decreasing to 192 mg/kg in the subsurface soil. This contaminant is well above the low risk HQ of 10.

- 4-amino-2,6-dinitrotoluene HQs at NOAA Area 6 were all below 1.0.

- The HQs for exposure to nitrate were 2 for the pygmy rabbit (M122A), deer mouse (M422), and sage sparrow (AV222). The exposure point concentrations in the surface soil is 250 mg/kg, decreasing to 75.5 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 6 at NOAA has a risk to ecological receptors from 2,4,6-TNT and 1,3-dinitrobenzene.

In summary, based on dose and HQ calculations and background comparisons, the primary potential risk-drivers at NOAA include 2,4,6-TNT (at Study Areas 2a, 3, 5, and 6), RDX (at Study Area 3), and 1,3-dinitrobenzene (at Study Area 6) in soil. The risk from UXO to ecological receptors is considered low. Complete ERA results are presented in Appendix F.

12.4.6 Fire Station II Zone and Range Fire Burn Area

12.4.6.1 Site Description. This area is located adjacent to the Fire Station II training site for the INEEL Fire Department (see Figure 12-7). It is located just east of Lincoln Boulevard at Mile Marker 5 and includes an area of approximately 324 ha (800 acres). In the early 1970s, the 324-ha (800-acre) area was included in a range fire that reportedly burned some UXO. Earlier Naval Proving Ground activities at the site included some low-order bomb detonations that scattered UXO and pieces of explosives over several areas of the site.

12.4.6.2 Previous Investigations. A 4-ha (10-acre) area was cleared to 0.61 m (2 ft) of UXO and pieces of explosives during the 1993 interim action, and only a few areas of explosive contaminated soils were found (see map in [DOE-ID 1997] Appendix H). A total of 20 samples were collected and analyzed from the area. The results ranged from 0.0 to 2,141 ppm for TNT and 0.0 to 4.7 ppm for RDX. Areas above the action levels were excavated by hand until the verification sample results met the cleanup levels of 44 ppm for TNT and 18 ppm for RDX.

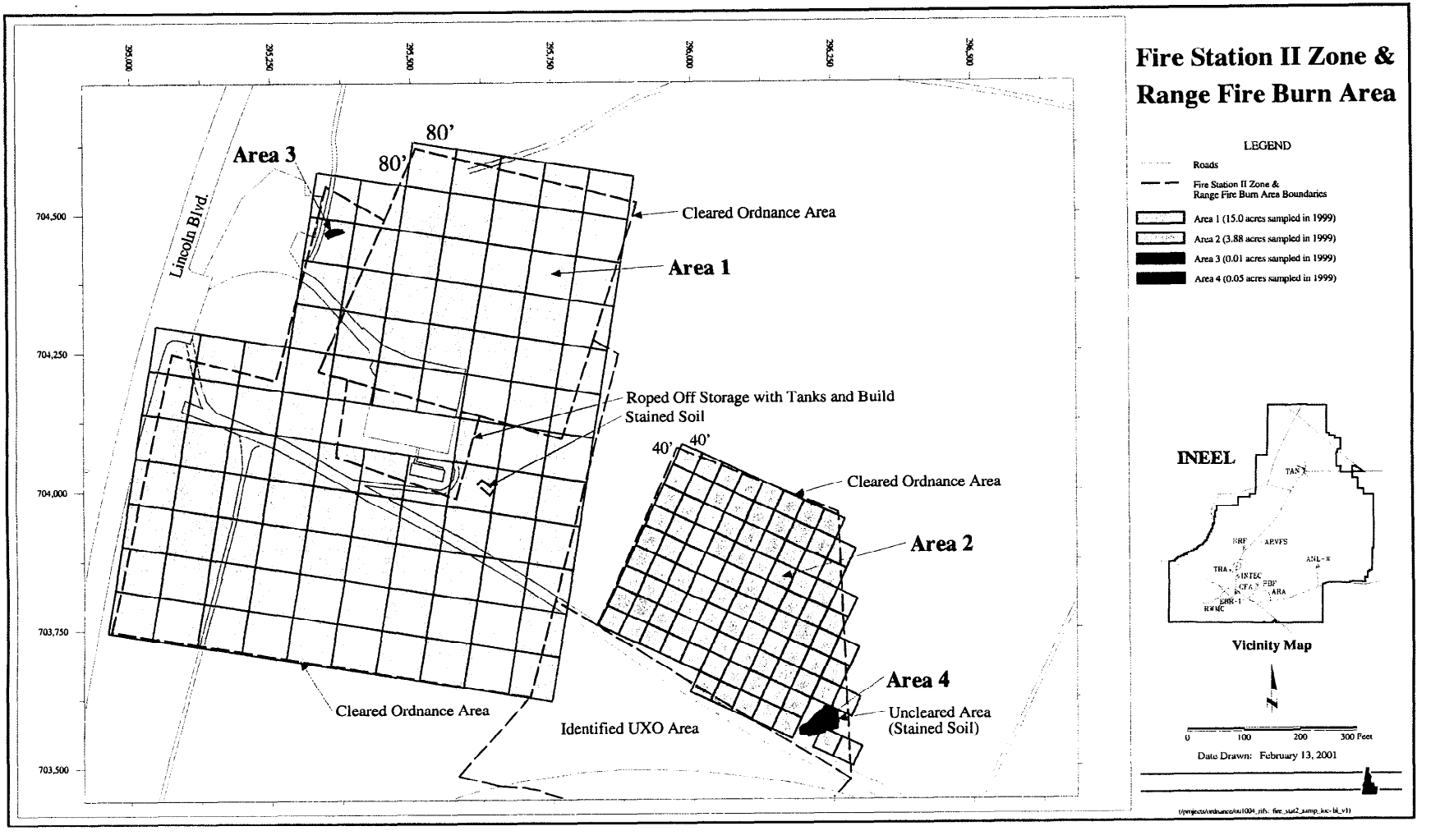

Figure 12-7. Location of the Fire Station II Zone and Range Fire Burn Area.

During the 1996 field assessment, the entire site was assessed, including the area outside the 4-ha (10-acre) site that was cleared of ordnance during the 1993 interim action. The assessment included a visual examination for signs of craters, detonation tests, surface UXO, pieces of explosives, and soil contamination. The boundary of soil contamination was extended and mapped. The burn area was covered during the sweep of the downrange area. The area outside of the 4-ha (10-acre) site was walked at 10-m (33-ft) intervals. The area searched extended out to the last identified piece of TNT, which became the tentative outer boundary of the site. From this piece, the search moved laterally, until another piece of TNT could be located. The search then again extended out to confirm that no other pieces could be found and then retracted to the last peripheral piece, which was flagged as the boundary. This search process was repeated until the entire boundary was established. In addition to the Fire Station II Area, the Range Fire Burn Area also was assessed. The search team fanned out in approximately 10-m (33-ft) intervals from the Fire Station II training area and walked east and northeast toward the Experimental Field Station (DOE-ID 1997).

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999b).

12.4.6.3 Preliminary Screening. The soil data collected from the 1999 field sampling were screened for COPCs. The results of that screening are presented in Table 12-27. The HHRA and ERA screening methodology are discussed in Section 4 and presented in detail in Appendices D and F, respectively. Phenanthrene was retained as COPCs for the HHRA because the RBC has not yet been established for this contaminant. 2,4,6-TNT and benzo(a)pyrene were retained as COPCs for the HHRA because the maximum concentrations exceeded the RBCs. 2,4,6-TNT, 4-amino-2,6-dinitrotoluene, chrysene, HMX, nitrite, RDX, TPH-diesel, and trichlorofluoromethane were retained as COPCs for the ERA because EBSLs have not yet been established for these contaminants. Copper, lead, nitrate, selenium, and xylene were also retained as COPCs for the ERA because the maximum concentrations exceeded the EBSLs.

12.4.6.4 Nature and Extent of Contamination. The Fire Station soils site was considered to represent four separate areas of contamination.

Maximum detected contamination levels are listed below for all HHRA and ERA COPCs. All contamination occurs at 0 to 0.61 m (0 to 2 ft) bgs.

- 2,4,6-TNT 1.30E+02 mg/kg
- 4-amino-2,6-dinitrotoluene 2.60E-01 mg/kg
- Benzo(a)pyrene 1.70E-01 mg/kg
- Copper 2.47E+01 mg/kg
- HMX 4.10E-01 mg/kg
- Lead 2.36E+01 mg/kg
- Nitrate 3.40E+02 mg/kg
- Nitrite 8.70E+01 mg/kg
- Phenanthrene 1.60E-01 mg/kg
- RDX 3.70E+00 mg/kg
- Selenium 1.60E+00 mg/kg
- TPH-diesel 1.20E+02 mg/kg
- Trichlorofluoromethane 1.20E-02 mg/kg
- Xylene 1.00E+00 mg/kg.

Table 12-27. Soil contaminant screening process for OU 10-04, Fire Station (1999).

		Step 1		Step 2	Step 3		Step 4		Site COPC	
Detected Contaminants	Max. Source Concentration (mg/kg)	INEEL Background Concentration (mg/kg)	Max. Concentration > Background	Nontoxic Metal	Region 9/3 RBC (mg/kg)	Max. Concentration > RBC	INEEL EBSL (mg/kg)	Max. Concentration > EBSL	HHRA	ERA
Area 1										
2,4,6-TNT	6.20E+01	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
Nitrate	3.40E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
RDX	1.10E+00	NA	NA	No	4.42E+00	No	No EBSL	No EBSL	No	Yes
Area 2										
2,4,6-TNT	2.30E+01	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
4-Amino-2,6-Dinitrotoluene	2.60E-01	NA	NA	No	4.70E+00	No	No EBSL	No EBSL	No	Yes
HMX	4.10E-01	NA	NA	No	3.06E+03	No	No EBSL	No EBSL	No	Yes
Nitrate	2.70E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	8.70E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes
RDX	3.70E+00	NA	NA	No	4.42E+00	No	No EBSL	No EBSL	No	Yes
Area 3										
Benzo(a)pyrene	1.70E-01	NA	NA	No	6.20E-02	Yes	2.69E+00	No	Yes	No
Copper	2.47E+01	2.20E+01	Yes	No	2.90E+03	No	2.11E+00	Yes	No	Yes
Iron	2.16E+04	2.40E+04	No	Yes	2.35E+04	No	No EBSL	No EBSL	No	No
Lead	2.36E+01	1.70E+01	Yes	No	4.00E+02	No	9.94E-01	Yes	No	Yes
Nitrite	4.70E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes
Phenanthrene	1.60E-01	NA	NA	No	NO RBC	No RBC	1.35E+02	No	Yes	No
Selenium	1.60E+00	2.20E-01	Yes	No	3.91E+02	No	1.72E-01	Yes	No	Yes
TPH-diesel	1.20E+02	NA	NA	No	1.00E+03	No	No EBSL	No EBSL	No—	Yes

Table 12-28. (continued).

Detected Contaminants	Max. Source Concentration (mg/kg)	Step 1: INEEL Background Concentration (mg/kg)	Step 1: Max. Concentration > Background	Step 2: Nontoxic Metal	Step 3: Region 9/3 RBC (mg/kg)	Step 3: Max. Concentration > RBC	Step 4: INEEL EBSL (mg/kg)	Step 4: Max. Concentration > EBSL	Site COPC: HHRA	Site COPC: ERA
Trichlorofluoromethane	1.20E-02	NA	NA	No	3.86E+02	No	No EBSL	No EBSL	No—	Yes
Xylene	1.00E+00	NA	NA	No	2.10E+02	No	2.78E-01	Yes	No	Yes
Area 4										
2,4,6-TNT	1.30E+02	NA	NA	No	1.62E+01	Yes	No EBSL	No EBSL	Yes	Yes
Nitrate	1.90E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	8.10E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes

Source: WAG 10, OU 10-04 Database.

"NA" in Step 1 indicates that a background value is not available.

"No RBC" indicates that an EPA Region 9 or 3 RBC based on residential soil ingestion is not available.

"No EBSL" indicates that an INEEL ecologically based screening level is not available.

Arsenic was removed from the ERA and HHRA COPC lists because detected levels are within the arsenic regional background ranges discussed in Appendix K.

The EBSL for benzo(a)pyrene was used to evaluate chrysene because of their similar properties and for the lack of needed information to create an EBSL for chrysene.

12.4.6.5 Risk Assessment. Table 12-28 presents the exposure point concentrations used in the baseline risk assessment. Appendix C contains both the summary statistics and exposure point concentrations supporting this assessment.

Table 12-28. Fire Station II Zone and Range Fire Burn Area Exposure Point Concentrations by Bin Depths.

COPC	0-0.5	0-4	0-10
Area 1			
2,4,6-Trinitrotoluene	6.20E+01	7.87E+00	3.15E+00
Nitrate	3.40E+02	2.09E+02	8.35E+01
RDX	7.78E-01	1.85E-01	7.39E-02
Area 2			
2,4,6-Trinitrotoluene	1.28E+01	1.71E+00	6.85E-01
4-Amino-2,6-Dinitrotoluene	2.60E-01	1.51E-01	6.03E-02
HMX	4.10E-01	4.10E-01	1.64E-01
Nitrate	2.70E+02	1.83E+02	7.30E+01
Nitrite	7.50E+01	6.98E+01	2.79E+01
RDX	3.70E+00	3.70E+00	1.48E+00
Area 3			
Benzo(a)pyrene	1.75E-01	1.75E-01	7.00E-02
Chrysene	6.40E-01	2.33E-01	9.33E-02
Copper	2.42E+01	2.28E+01	9.12E+00
Lead	2.36E+01	1.56E+01	6.26E+00
Nitrite	4.70E+01	3.91E+01	1.57E+01
Phenanthrene	1.75E-01	1.75E-01	7.00E-02
Selenium	1.57E+00	1.60E+00	6.39E-01
TPH-Diesel	1.20E+02	3.82E+01	1.53E+01
Trichlorofluoromethane	1.20E-02	5.88E-03	2.35E-03
Xylene	1.00E+00	5.63E-01	2.25E-01
Area 4			
2,4,6-Trinitrotoluene	1.30E+02	1.21E+02	4.85E+01
Nitrate	1.90E+02	8.76E+01	3.51E+01
Nitrite	8.10E+01	4.08E+01	1.63E+01

EPC units are mg/kg or pCi/g; bin depths are in feet.

12.4.6.5.1 Human Health—The estimated human health risks at the Fire Station II Zone and Range Fire Burn Area vary by area (Table 12-29), but the risk values for all areas and scenarios are within or below the 1E-04 to 1E-06 risk range.

The total noncarcinogenic hazard to future residents is above 1 for Area 4 and is at 1 for Area 1. The total noncarcinogenic hazards to current and future workers are less than 1 for all areas. The primary contributor to these hazard values is ingestion of homegrown produce contaminated with 2,4,6-TNT.

12.4.6.5.2 Ecological—In order to better characterize the Fire Station area and because this site covers such a large area, it was divided into four separate areas. This was also done to help keep the contaminants limited to the area in which they were found. Then, if remediation is needed, it will be limited to the contaminated area and less of the habitat will be destroyed. The COPCs for the ERA include several inorganic and explosive compounds for the surface and subsurface soils. Only COPCs with HQs greater than 10 will be retained for further evaluation in the ERA. These HQs and COPCs are presented in bold in Tables 12-30 through 12-30 unless no HQ exceeded 10. COPCs with HQs less than or equal to 10 are eliminated from the ERA because they pose a low risk to ecological receptors and no longer need to be evaluated. HQs for the COPCs from this site ranged from 1 to 40. Risks from these contaminants to reptiles, amphibians, and invertebrates could not be evaluated because of the lack of toxicity data to develop toxicity reference values (the contaminants are discussed in greater detail below and may contain a few more data gaps because of the lack of toxicity data, so are discussed more quantitatively). Also, a few of the COPCs for this site could not be assessed for ecological risk because of the lack of toxicity information. These COPCs will be discussed in greater detail under their designated areas.

Area 1

HQs for the COPCs from this area ranged from 1 to 20. Risks to birds and plants could not be assessed from exposure to 2,4,6-TNT and RDX. Furthermore, risk to plants could not be assessed for nitrate.

Table 12-29. Human health carcinogenic risk and noncarcinogenic hazard index summary for Fire Station II Zone and Range Fire Burn Area.

Area	Risk Scenario			Hazard Index Scenario		
	Residential	Current Worker	Future Worker	Residential	Current Worker	Future Worker
1	1E-05	3E-06	3E-06	1E+00	6E-02	6E-02
2	6E-06	7E-07	7E-07	9E-01	1E-02	1E-02
3	4E-05	1E-05	1E-05	6E-01	8E-05	8E-05
4	8E-05	7E-06	7E-06	9E+00	1E-01	1E-01

Source: HHRA Spreadsheets. See Appendix E.

Table 12-30. Summary of ERA HQs for the Fires Station II Zone and Range Fire Burn Area 1.

COPCs Receptors	2,4,6-TNT HQs	Nitrate HQs	RDX HQs
Deer mouse	9	2	4
Loggerhead shrike	—	1	—
Pygmy rabbit	20	2	9
Sage sparrow	—	5	—
Townsend's western big-eared bat	—	3	—

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at the Fire Station Area 1 are discussed below.

- The HQs for exposure to 2,4,6-TNT ranged from 9 for the deer mouse (M422) to 20 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 62 mg/kg, decreasing to 3.15 mg/kg in the subsurface soil. This contaminant is above the low risk HQ of 10 for the pygmy rabbit.

- The HQs for exposure to nitrate ranged from 2 for the pygmy rabbit (M122A), mourning dove (AV122), and deer mouse (M422) to 3 for the loggerhead shrike (AV322) to 4 for Townsend's western big-eared bat (M210A) to 5 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 340 mg/kg, decreasing to 83.5 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The HQs for exposure to RDX ranged from 4 for the deer mouse (M422) to 9 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 0.78 mg/kg, decreasing to 0.07 mg/kg in the subsurface soil. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Area 1 at the Fire Station has a risk to ecological receptors from 2,4,6-TNT.

Area 2

HQs for the COPCs from this area ranged from 1 to 40. Risks to birds and plants could not be assessed from exposure to 2,4,6-TNT, 4-amino-2,6-dinitrotoluene, HMX, and RDX. Furthermore, risk to plants could not be assessed for nitrate and nitrite.

Table 12-31. Summary of ERA HQs for the Fires Station II Zone and Range Fire Burn Area 2.

COPCs Receptors	2,4,6-TNT HQs	Nitrate HQs	Nitrite HQs	RDX HQs
Deer mouse	2	2	—	20
Loggerhead shrike	—	1	—	—
Mule deer	—	—	—	2
Pygmy rabbit	4	2	—	40
Sage sparrow	—	4	1	—
Townsend's western big-eared bat	—	2	—	—

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at the Fire Station Area 2 are discussed below:

- The HQs for exposure to 2,4,6-TNT ranged from 2 for the deer mouse (M422) to 4 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 12.8 mg/kg, decreasing to 0.68 mg/kg in the subsurface soil. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.
- 4-amino-2,6-dinitrotoluene HQs at the Fire Station Area 2 were all below 1.0.
- HMX HQs at the Fire Station Area 2 were all below 1.0.
- The HQs for exposure to nitrate ranged from 1 for the loggerhead shrike (AV322) to 2 for the pygmy rabbit (M122A), Townsend's western big-eared bat (M210A), and deer mouse (M422) to 4 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 270 mg/kg, decreasing to 73 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.
- The only HQ greater than 1 for exposure to nitrite was a 1 for the sage sparrow (AV222). The exposure point concentration in the surface soil is 75 mg/kg, decreasing to 28 mg/kg in the subsurface soil. The INEEL background value for nitrite has been neither evaluated nor made available at this time. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.
- The HQs for exposure to RDX ranged from 2 for the mule deer (M122) to 20 for the deer mouse (M422) to 40 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 3.7 mg/kg, decreasing to 1.5 mg/kg in the subsurface soil. This contaminant is above the low risk HQ of 10.

The risk evaluation indicates that Area 2 at the Fire Station area has a risk to ecological receptors from RDX.

Area 3

HQs for the COPCs from this area ranged from 1 to 8. Risks to birds and plants could not be assessed from exposure to TPH, and xylene. Furthermore, risk to plants could not be assessed for nitrite. Trichlorofluoromethane was among these COPCs, but no toxicity information could be found to assess ecological risk. This contaminant was considered low risk because its concentration was found at low levels (exposure point concentration in the surface soil was 0.012 mg/kg to 0.006 mg/kg in the subsurface soil). For this reason, it is unlikely to pose significant risk to any ecological receptor and will no longer be evaluated.

Table 12-32. Summary of ERA HQs for the Fires Station II Zone and Range Fire Burn Area 3.

COPCs Receptors	Copper HQs	TPH-diesel HQs
Deer mouse	2	1
Pygmy rabbit	3	8

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at the Fire Station Area 3 are discussed below.

- The HQs for exposure to copper ranged from 1 for the deer mouse (M422) to 3 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 24.2 mg/kg, decreasing to 9.12 mg/kg in the subsurface soil. The INEEL background concentration for copper is 22 mg/kg. Therefore, an average species may be exposed to the same magnitude of risk from exposure to background. This contaminant was eliminated as a COPC because the HQ fell below 10, which indicates a low risk to ecological receptors.

- Lead HQs at the Fire Station Area 3 were all below 1.0.

- Nitrite HQs at the Fire Station Area 3 were all below 1.0.

- Selenium HQs at the Fire Station Area 3 were all below 1.0.

- The HQs for exposure to TPH-diesel ranged from 1 for the deer mouse (M422) to 8 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil was 120 mg/kg, decreasing to 15.3 mg/kg in the subsurface soil. Toxicity reference values from benzene were used to evaluate this contaminant because benzene is the most hazardous chemical found in TPH-diesel. This was done because toxicity reference values for TPH-diesel could not be developed, due to the lack of toxicity data. This contaminant was eliminated as a COPC because the HQs were equal to or below 10, which indicates a low risk to ecological receptors.

- Xylene HQs at the Fire Station Area 3 were all below 1.0.

The risk evaluation indicates that Area 3 at Fire Station has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for the Fire Station Area 3.

Area 4

HQs for the COPCs from this area ranged from 1 to 4. Risks to birds and plants could not be assessed for threats from exposure to 2,4,6-TNT. Furthermore, risk to plants could not be assessed for nitrate and nitrite.

Table 12-33. Summary of ERA HQs for the Fires Station II Zone and Range Fire Burn Area 4

COPCs Receptors	2,4,6-TNT HQs	Nitrate HQs	Sulfate HQs
Deer mouse	2	1	4
Pygmy rabbit	4	1	4

COPCs with HQs less than one are not presented in this table.

The HQs for the COPCs at the Fire Station Area 4 are discussed below:

- The HQs for exposure to 2,4,6-TNT ranged from 2 for the deer mouse (M422) to 4 for the pygmy rabbit (M122A). The exposure point concentration in the surface soil is 130 mg/kg, decreasing to 48.5 mg/kg in the subsurface soil. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- The only HQ greater than 1 for exposure to nitrate was a 1 for the pygmy rabbit (M122A) and deer mouse (M422). The exposure point concentration in the surface soil is 190 mg/kg, decreasing to 35.1 mg/kg in the subsurface soil. The INEEL background value for nitrate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs fell below 10, which indicates a low risk to ecological receptors.

- Nitrite HQs at the Fire Station Area 4 were all below 1.0. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data.

- The only HQ greater than 1 for exposure to sulfate was a 4 for the pygmy rabbit (M122A) and deer mouse (M422). The exposure point concentration in the surface soil is 200 mg/kg, decreasing to 33.1 mg/kg in the subsurface soil. The INEEL background value for sulfate has been neither evaluated nor made available at this time. This contaminant was eliminated as a COPC because the HQs were equal to or below 10, which indicates a low risk to ecological receptors.

The risk evaluation indicates that Fire Station Area 4 has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for Fire Station Area 4.

In summary, based on dose and HQ calculations and background comparisons, the primary potential risk-drivers at the Fire Station include 2,4,6-TNT (at Area 1) and RDX (at Area 2) in soil. The risk from UXO to ecological receptors is considered low. Complete ERA results are presented in Appendix F.

12.4.7 Mass Detonation Area

12.4.7.1 Site Description. The Mass Detonation Area is located 1.6 km (1 mi) east of Mile Marker 8 on Lincoln Boulevard. The area is north of the INTEC and approximately 3.2 km (2 mi) east of the NRF, as shown in Figure 12-8. The site encompasses 322 ha (796 acres) and has been used for a number of small- to large-scale sympathetic and mass detonation tests, with test shots ranging up to 226,800 kg (500,000 lb) of explosives. A sympathetic detonation test is a test to find out if a charge explodes when another charge is detonated next to it. The site includes numerous blast craters varying in dimensions from a few feet to several tens of feet and is littered with large quantities of UXO, pieces of explosives, and structural debris scattered during past testing and recent ordnance detonation or disposal activities, or both (DOE-ID 1997).

During the 1996 field assessment, field crews searched the entire area on foot at approximately 50-m (164-ft) intervals. The boundary of the mapped area was established at the last piece of fragmentation located (see map in Appendix H). The assessment included visual examination for signs of craters, detonation tests, surface UXO, pieces of explosives, and soil contamination. The mapped area determined to require subsurface clearance is approximately 2.4 km (1.5 mi) in diameter (DOE-ID 1997).

In 1999, surface soil samples were collected as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999b).

12.4.7.2 Preliminary Screening. The soil data collected from the 1997 and 1999 field sampling efforts were screened for COPCs. The results of that screen are presented in Table 12-34. The HHRA and ERA screening methodology are discussed in Section 4 and presented in detail in Appendices D and F, respectively. No COPCs were retained for the HHRA. For the ERA, nitrite was retained as COPC because an EBSL has not yet been established for this contaminant; 2,4-dinitrotoulene was also retained because the maximum concentration exceeded the EBSL.

12.4.7.3 Nature and Extent of Contamination. Maximum detected contamination levels are listed below for all COPCs. All contamination occurs at 0 to 0.61 m (0 to 2 ft) bgs.

- 2,4-Dinitrotoluene 3.50E + 01 mg/kg
- Nitrate 4.90E + 01 mg/kg

12.4.7.4 Risk Assessment. Appendix C presents the exposure point concentrations used in the baseline risk assessment. Appendix C contains both the summary statistics and exposure point concentrations supporting this assessment.

12.4.7.4.1 Human Health—No HHRA was performed for this site.

12.4.7.4.2 Ecological—.From the preliminary screening, the COPCs for the ERA include 2,3-dinitrotrotoluene and nitrite. Exposure point concentrations for the ERA were calculated to be 0.22 mg/kg for 2,4-dinitrotoluene and 36 mg/kg for nitrite in the surface soil. Only COPC with HQs greater than 10 will be retained for further evaluation in the ERA. HQs from the contaminants at this site were all below 1 for further evaluation in the ERA. Risks from the COPCs to reptiles, amphibians, and invertebrates could not be evaluated because of the lack of toxicity data to develop toxicity reference values. Risks to birds and plants could not be assessed for threats from exposure to 2,4-dinitrotoluene. Furthermore, risk to plants could not be assessed for nitrite. The HQs for the COPCs at the Mass Detonation Area are discussed below:

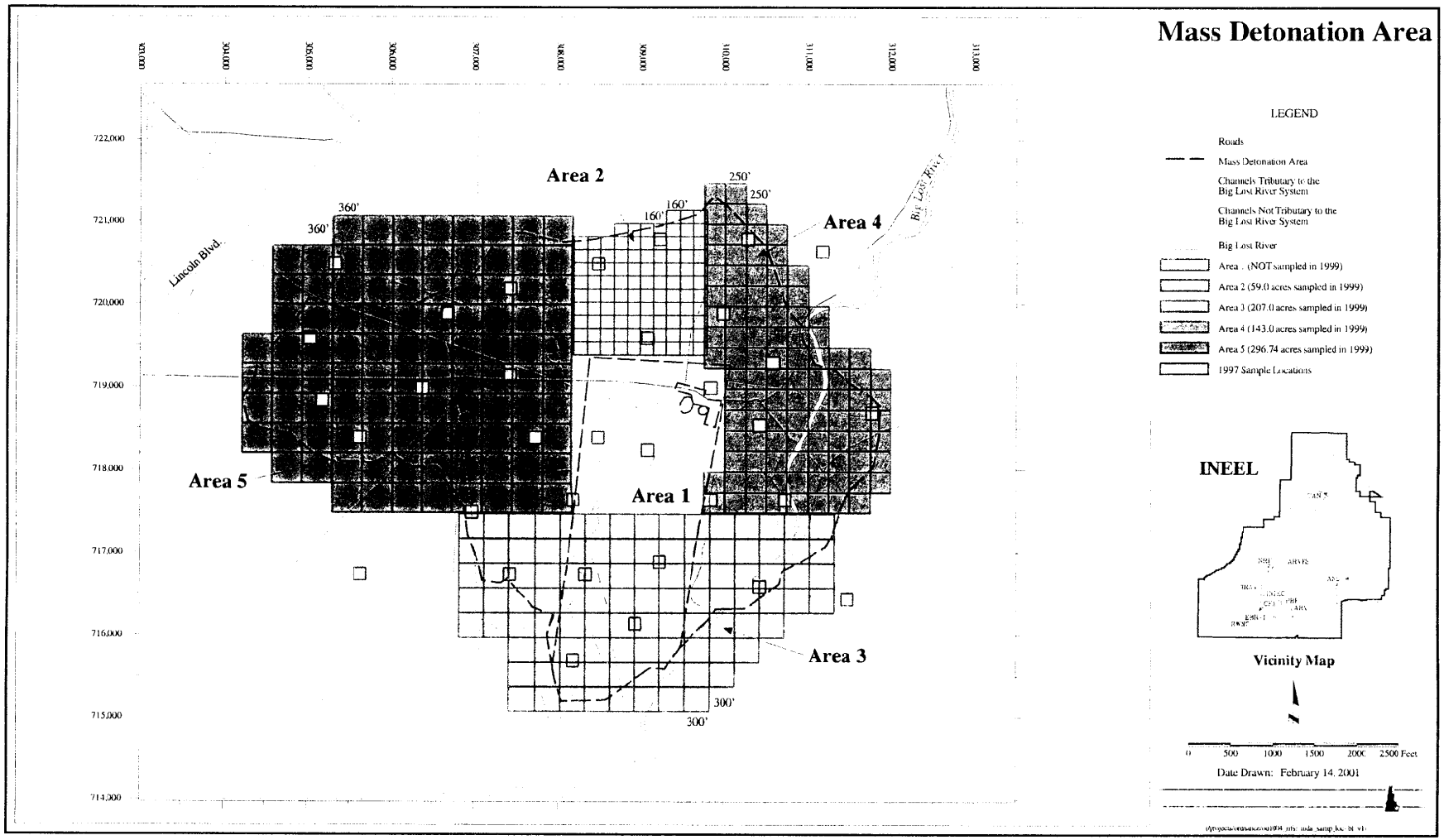

Figure 12-8. Location of Mass Detonation Area.

Table 12-34. Soil contaminant screening process for OU 10-04, Mass Detonation Area soils (1997, 1999).

		Step 1		Step 2	Step 3		Step 4		Site COPC	
Detected Contaminants	Max. Source Concentration (mg/kg)	INEEL Background Concentration (mg/kg)	Max. Concentration > Background	Nontoxic Metal	Region 9/3 RBC (mg/kg)	Max. Concentration > RBC	INEEL EBSL (mg/kg)	Max. Concentration > EBSL	HHRA	ERA
2,4-Dinitrotoluene	3.50E+01	NA	NA	No	1.22E+02	No	1.54E+00	Yes	No	Yes
Nitrite	4.90E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes

Source: WAG 10, OU 10-04 Database.

"NA" in Step 1 indicates that a background value is not available.

"No RBC" indicates that an EPA Region 9 or 3 risk-based concentration based on residential soil ingestion is not available.

"No EBSL" indicates that an INEEL ecologically based screening level is not available.

Chloride was removed from the ERA and HHRA COPC lists (see discussion in Appendix F).

Fluoride was removed from the ERA COPC list (see discussion in Appendix F).

Sulfate was removed from the ERA and HHRA COPC lists (see discussion in Appendix F).

Table 12-36. Soil contaminant screening process for OU 10-04, UXO east of TRA soil.

		Step 1		Step 2	Step 3		Step 4		Site COPC	
Detected Contaminants	Max. Source Concentration (mg/kg)	INEEL Background Concentration (mg/kg)	Max. Concentration > Background	Nontoxic Metal	Region 9/3 RBC (mg/kg)	Max. Concentration > RBC	INEEL EBSL (mg/kg)	Max. Concentration > EBSL	HHRA	ERA
2,4,6-TNT	4.60E+00	NA	NA	No	1.62E+01	No	No EBSL	No EBSL	No	Yes
2,6-Dinitrotoluene	4.70E-01	NA	NA	No	6.11E+01	No	2.18E+00	No	No	No
Lead	9.50E+00	1.70E+01	No	No	4.00E+02	No	9.94E-01	Yes	No	No
Nitrate	2.50E+02	NA	NA	No	1.25E+05	No	1.84E+01	Yes	No	Yes
Nitrite	7.50E+01	NA	NA	No	7.82E+03	No	No EBSL	No EBSL	No	Yes

Source: WAG 10, OU 10-04 Database.

"NA" in Step 1 indicates that a background value is not available.

"No RBC" indicates that an EPA Region 9 or 3 RBC based on residential soil ingestion is not available.

"No EBSL" indicates that an INEEL ecologically based screening level is not available.

- 2,4-dinitrotoluene HQs at the Mass Detonation area were all below 1.0.

- Nitrite HQs at Mass Detonation Area were all below 1.0. Toxicity reference values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. Toxicity reference values for nitrite could not be developed because of the lack of toxicity data.

The risk evaluation indicates that Mass Detonation Area has limited risk to ecological receptors from exposure to soils from this area. No COPCs were retained for further evaluation in the ERA for the Mass Detonation Area. The risk from UXO to ecological receptors is considered low. The complete ERA results are presented in Appendix F.

12.4.8 Unexploded Ordnance East of TRA

12.4.8.1 Site Description. Approximately 18 low-ordered U.S. general purpose bombs that contained partially burned explosive filler were found at this site, which is located east of TRA, between the old Monroe Road and Power Line Road (see Figure 12-9). The area covers approximately 2 ha (5 acres).

The 18 low-ordered bombs were transported to the Mass Detonation Area for disposal by detonation during the 1996 removal action. The area was then surface-cleared of pieces of TNT, explosive boosters, and ordnance scrap, which were also transported to the Mass Detonation Area for disposal by detonation (see the map in Appendix H/DOE-ID 1997).

In 1999, surface soil samples were collected, as described in the *Field Sampling Plan (FSP) for Operable Unit (OU) 10-04 Explosive Compounds* (DOE-ID 1999b).

12.4.8.2 Previous Investigations. This site contained approximately 18 low-ordered U.S. general-purpose bombs having partially burned explosive filler. The bombs were located east of TRA, between the old Monroe Road and Power Line Road. The bombs had live boosters and still contained explosives, though some had split and spilled TNT onto the ground (DOE-ID 1997).

12.4.8.3 Preliminary Screening. The soil data collected from the 1997, 1999, and 2000 field sampling were screened for COPCs. The results of that screening are presented in Table 12-35. The HHRA and ERA screening methodology are discussed in Section 4 and presented in detail in Appendices D and F, respectively. No COPCs were retained for the HHRA. 2,4,6-TNT and nitrite were retained as COPCs in the ERA because EBSLs have not yet been established for these contaminants. Nitrate was also retained as a COPC in the ERA because the maximum concentration exceeded the EBSL.

12.4.8.4 Nature and Extent of Contamination. Maximum detected contamination levels are listed below for all COPCs. All contamination occurs at 0 to 0.61 m (0 to 2 ft) bgs.

- 2,4,6-TNT 4.60E+00 mg/kg

- Nitrate 2.50E+02 mg/kg

- Nitrite 7.50E+01 mg/kg.

12.4.8.5 Risk Assessment. Appendix C presents the exposure point concentrations used in the baseline risk assessment. Appendix C also contains both the summary statistics and exposure point concentrations supporting this assessment.

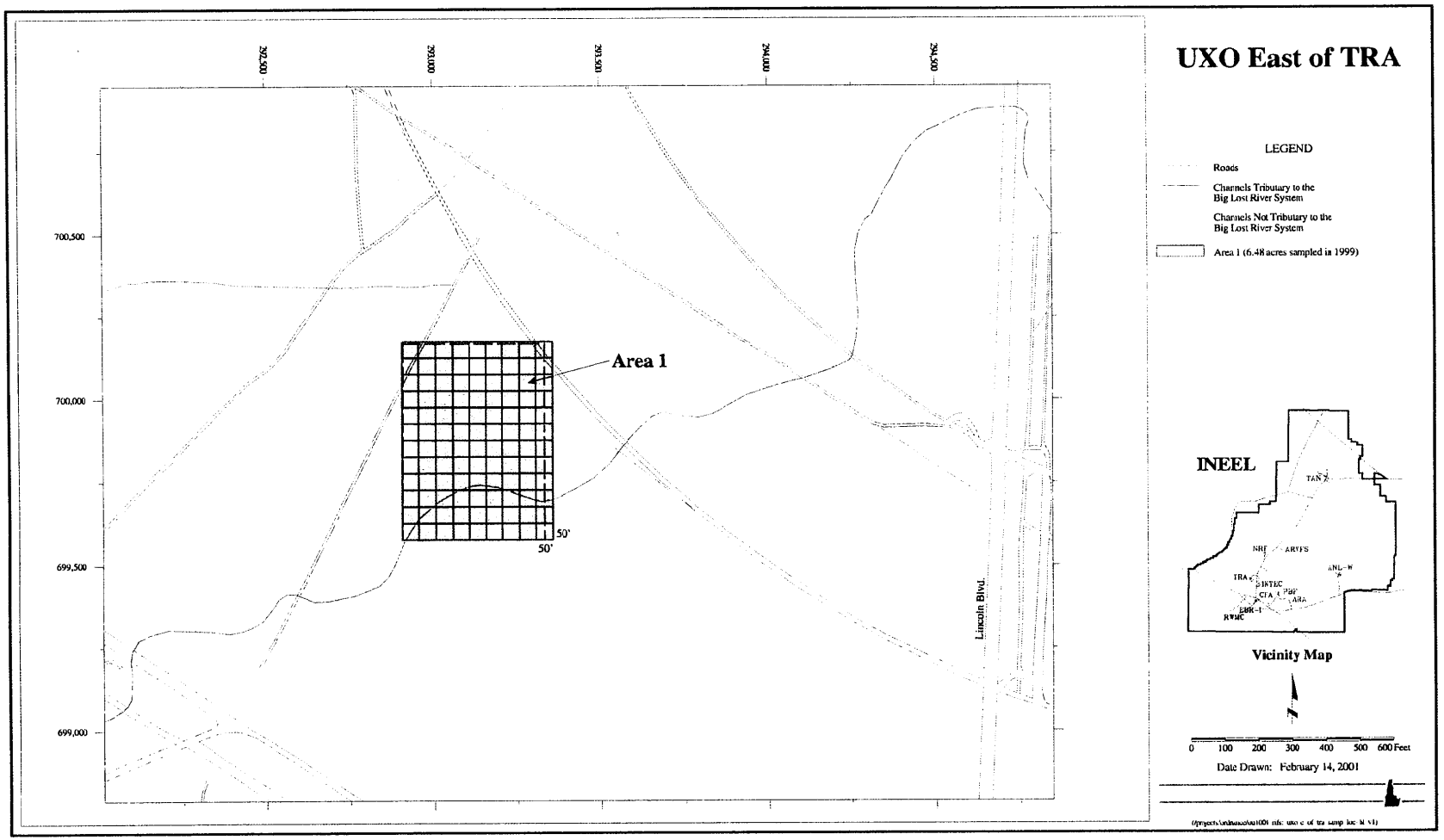

Figure 12-9. Location of Unexploded Ordnance Area East of TRA.